Utah Division of Air Quality

Western Wildfire Smoke Exceptional Events September 5 – 7, 2017

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Introduction

The Code of Federal Regulations (40 CFR 50.14) states that “a State…may request the Administrator (Environmental Protection Agency) to exclude data showing exceedances or violations of any national ambient air quality standard that are directly due to an exceptional event…by demonstrating to the Administrator's satisfaction that such event caused a specific air pollution concentration at a particular air quality monitoring location.” An exceptional event means an event that affects air quality, is not reasonably controllable or preventable, or a natural event, such as a wildfire.

The demonstration to justify data exclusion, as outlined in 40 CFR 50.14, specifies that the following evidence must be provided:

1. A narrative conceptual model that describes the event;

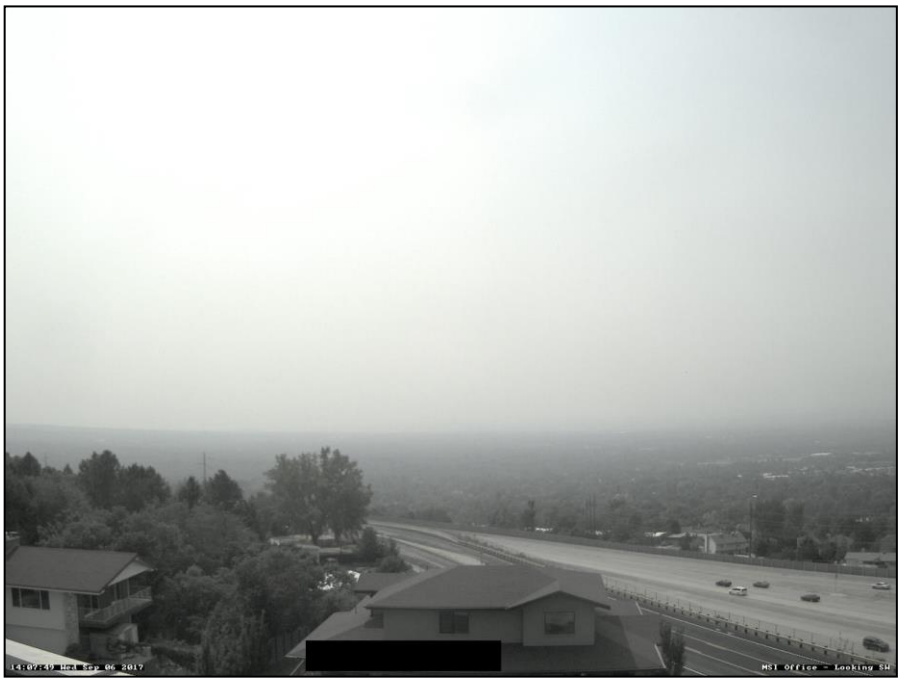
2. There is a clear causal relationship between the measurements under consideration and the event that is claimed to have affected air quality in the area;

3. Analyses comparing the claimed event influenced concentrations to concentrations at the same monitoring site at other times;

4. A state must take appropriate and reasonable actions to protect public health from exceedances or violations of the national ambient air quality standards by developing and implementing a mitigation plan for recurring events and;

5. The Event documentation must be made available for a 30-day public comment period.

This documentation is being submitted to EPA in order to exclude $PM_{2.5}$ exceedances of the 24-hour standard of 35 µg/m^3 that occurred in norther Utah due to smoke from western wildfires. This image (courtesy of MSI) shows the intensity of the smoke in Salt Lake City on September 6, 2017 at 2 p.m.



The following monitoring stations filters exceeded the $PM_{2.5}$ 24-hour standard (in µg/m^3);

September 5, 2017

~~Brigham City (BR)~~	~~41.6~~
~~Smithfield (SM)~~	~~41.4~~
Smithfield co-located (SX)	38.2

September 6, 2017

Bountiful (BV)	43.7
Brigham City	~~51.5~~41.6
Erda (ED)	38
Hawthorne (HW)	35.5
Ogden (O2)	39
Magna (MG)	37.1
Rose Park (RP)	37.8
Rose Park co-located (RX)	37.7
Smithfield	60.1
Smithfield co-located	47.2
~~Spanish Fork (SF)~~	~~39.9~~

September 7, 2017

~~Brigham City~~	~~36.4~~
~~Smithfield~~	~~42.4~~

The following monitoring stations continuous monitors exceeded the $PM_{2.5}$ 24-hour standard (in µg/m^3);

9/5/2017

		Summary		
Parameter	**Site Name**	**Avg**	**Max**	**Hr. of Max**
MC	**BR**	**36.2**	**56.8**	**20**
	SM	**52.~~2~~7**	**146.0**	**18**

9/6/2017

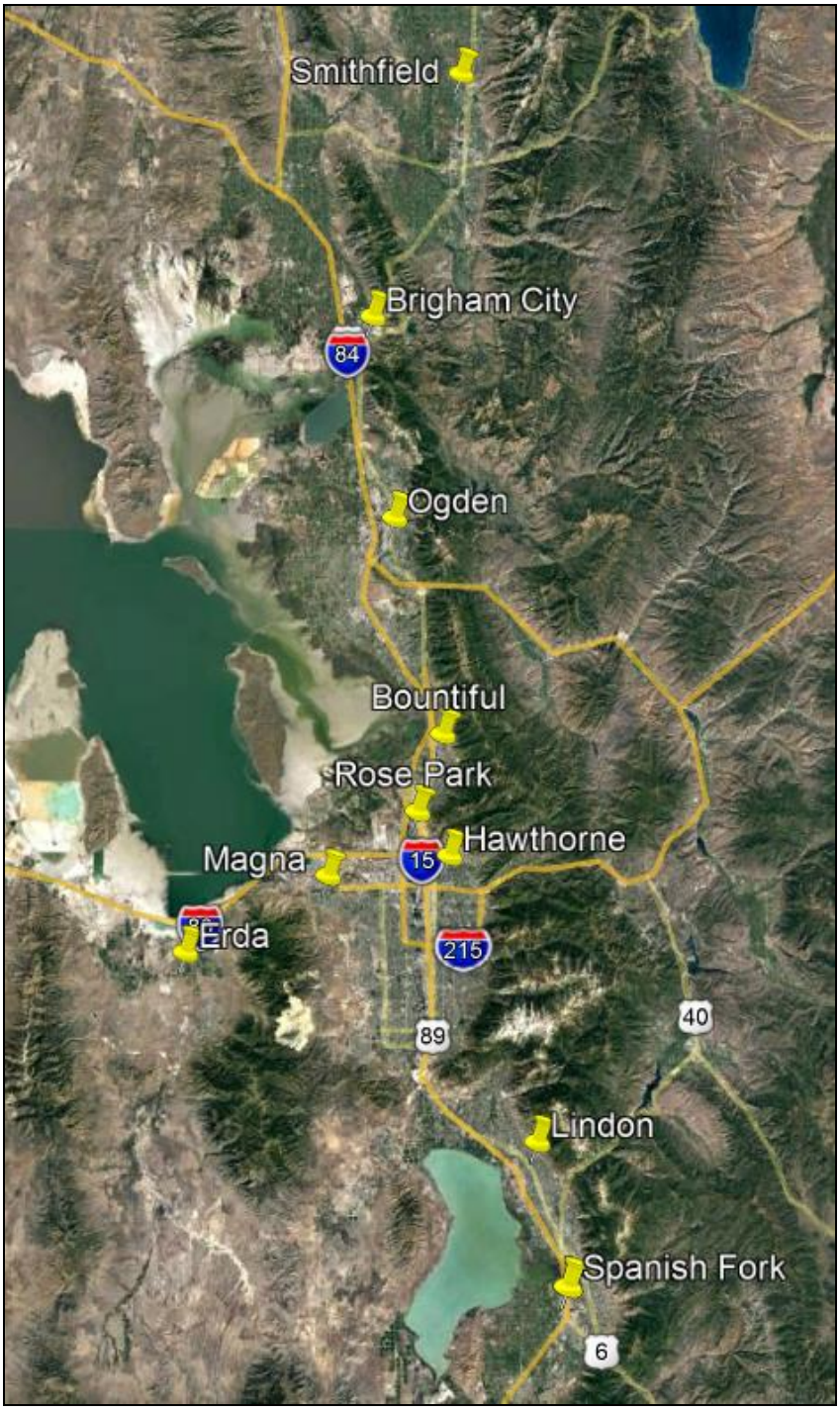
		Summary		
Parameter	**Site Name**	**Avg**	**Max**	**Hr. of Max**
MC	**BR**	**44.0**	**52.6**	**04**
	BV	**43.4**	**63.8**	**19**
	ED	**43.4**	**53.6**	**18**
	LN	**35.0**	**49.4**	**10**
	O2	**38.7**	**56.8**	**00**
	RP	**36.8**	**47.3**	**22**
	SM	**6~~5.0~~4.1**	**98.0**	**07**

LN=Lindon

9/7/2017

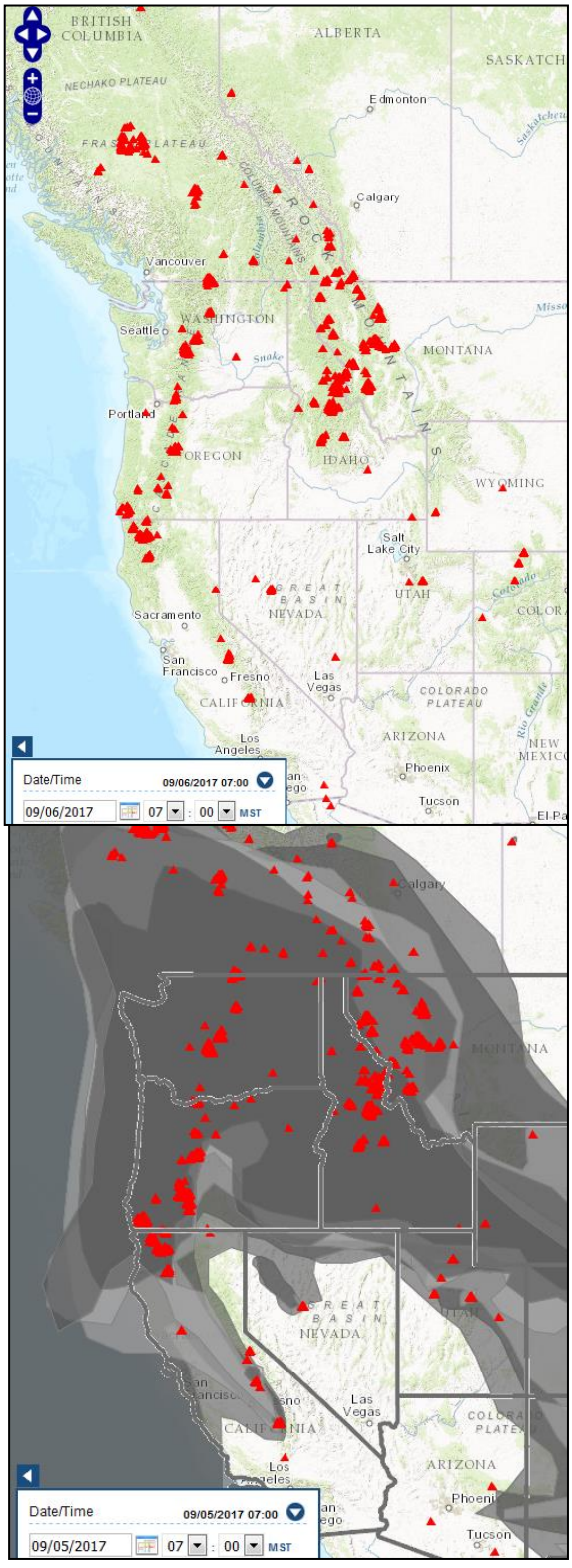
		Summary		
Parameter	**Site Name**	**Avg**	**Max**	**Hr. of Max**
MC	**SM**	**37.9**	**54.7**	**05**

The monitoring station locations are shown on the Google Earth map.

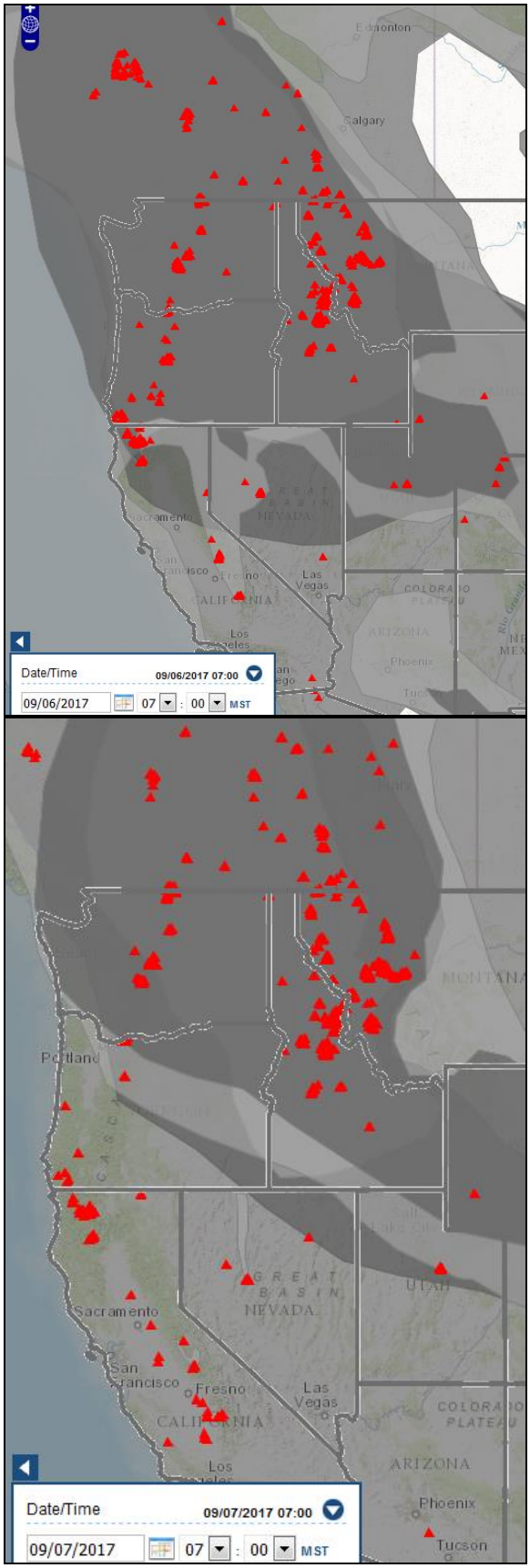


Conceptual Model

Smoke from wildfires across the west was transported to Utah starting the morning hours on September 5 through September 7, 2017 that resulted in exceedances of the $PM_{2.5}$ 24-hour standard at the northern monitoring stations. The upper figure shows the locations of the major western fires burning on September 5 through 6. The lower figure shows the NOAA smoke map projections for September 5, 2017.



The NOAA smoke maps for September 6 and 7, 2017.



Utah Wildfire Contribution

In addition to wildfire smoke from adjoining western states, the Tank Hollow Fire, located 19 miles east of Spanish Fork, contributed smoke to southern Utah County during a portion of the Event days. The Tank Hollow Fire was caused by lightning strike on August 11, 2017 and continues to burn at the time of this documentation (see the Incident Report below).

Tank Hollow

Incident Information | Announcements | Closures | News | Photographs | Maps

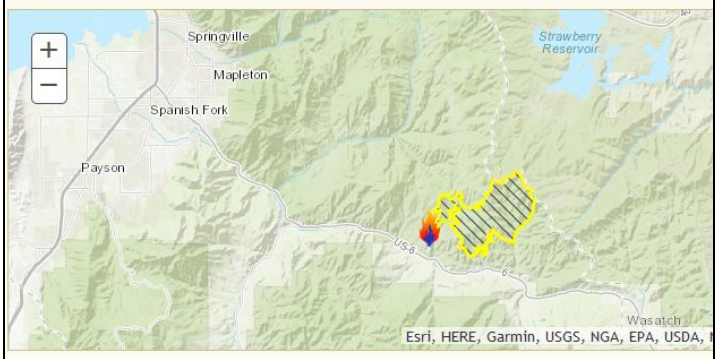
ANNOUNCEMENT

The Closure has been lifted for FS Roads #042 and #043
Forest Service Roads #042 (Indian Creek Road) and #043 are now open for travel and dispersed camping. more

INCIDENT UPDATED 24 HRS. AGO

Approximate Location

39.994 latitude, -111.316 longitude zoom to incident



Incident Overview

The Tank Hollow fire is burning in the Sheep Creek drainage on the Spanish Fork Ranger District of the Uinta-Wasatch-Cache National Forest. This lightning-caused fire started on August 11th.

Image options: [Enlarge] [Full Size]

Fire managers, along with personnel from the U.S Forest Service, State of Utah Department of Natural Resources, Utah Division of Forestry, Fire, and State Lands, and the Bureau of Land Management, are assigned to the fire. The fire is being suppressed to protect critical watershed and transmission lines.

Forest Service Unicorn Campground, Forest Service road #042 and Forest Service road #043 are now open for public access. The following roads and trails remain closed due to the potential of mud slides and snags or dead standing trees that could fall throughout these areas which pose a public safety risk: Forest Service roads (Forest Service road #032), (Forest Service road #761) (Tie Fork road, Forest Service road #725) and Upper Tie Fork Single Track Trail (Forest Service trail #023). This includes all pedestrian, equestrian, bicycle and any type of motorized vehicle.

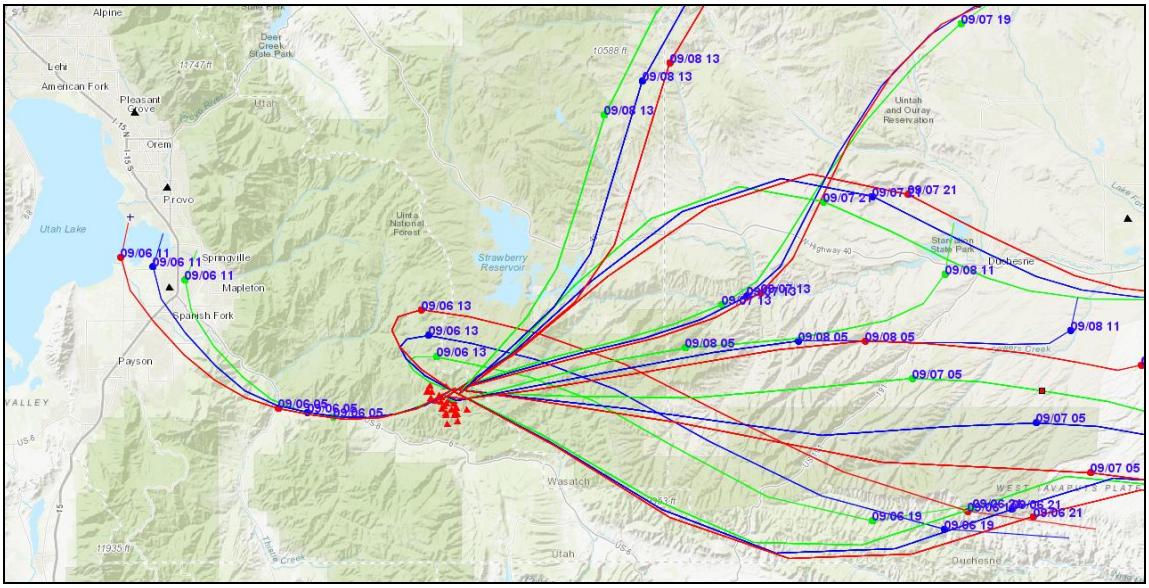
Basic Information

Current as of	9/28/2017, 8:56:13 AM
Incident Type	Wildfire
Cause	Lightning
Date of Origin	Friday August 11th, 2017 approx. 09:45 AM
Location	19 miles east of Spanish Fork, Utah, North of Highway 6 below the paved Sheep Creek road
Incident Commander	Forest Service

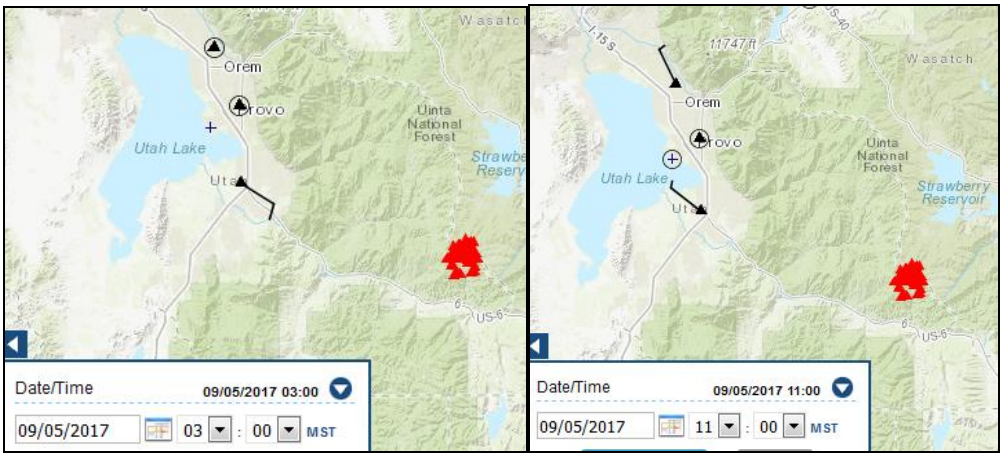
Current Situation

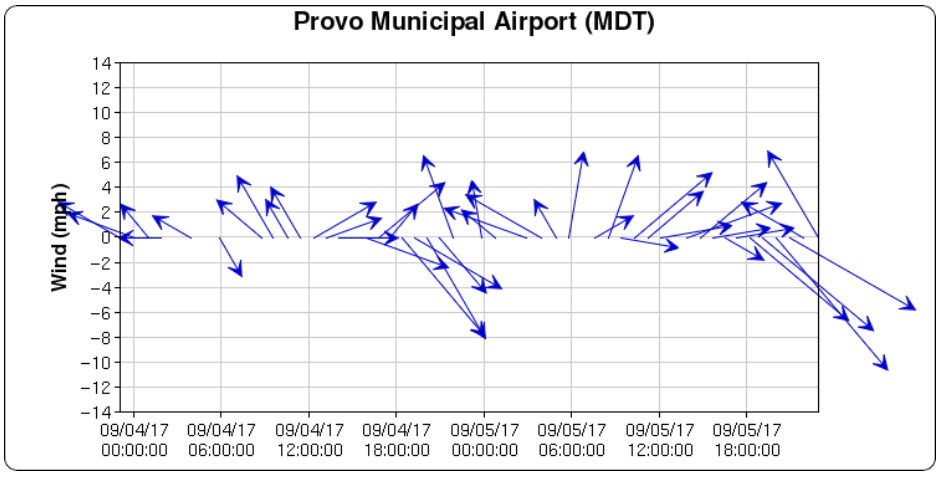
Total Personnel	1
Size	11,067 Acres
Percent of Perimeter Contained	85%
Estimated Containment Date	Sunday October 15th, 2017 approx. 06:00 PM
Fuels Involved	Timber (grass and understory) Brush (2 feet) Short grass (1 foot) Fuels in the fire area are juniper, grass and sage/shrub on the lower, drier slopes and mixed conifer, primarily Douglas Fir with an understory of litter, shrubs and small trees at higher elevations.
Significant Events	Minimal fire behavior, smoldering. Fire behavior low with possibility for smoke within the perimeter.

Hysplit 12-hour forward trajectories (50,100 and 150 meters) indicate a western flow of smoke from the fire complex on September 6 at 0300 hours, reaching the Spanish Fork monitoring station at 1100 hours.



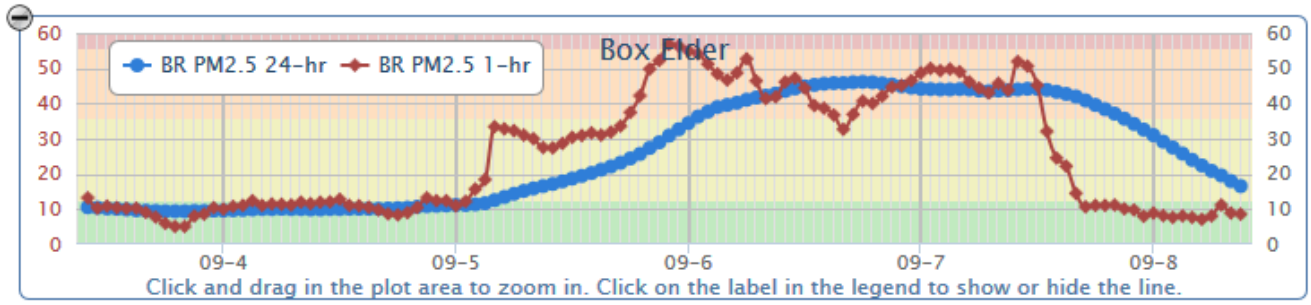
These trajectories are consistent with surface wind measurements shown below.

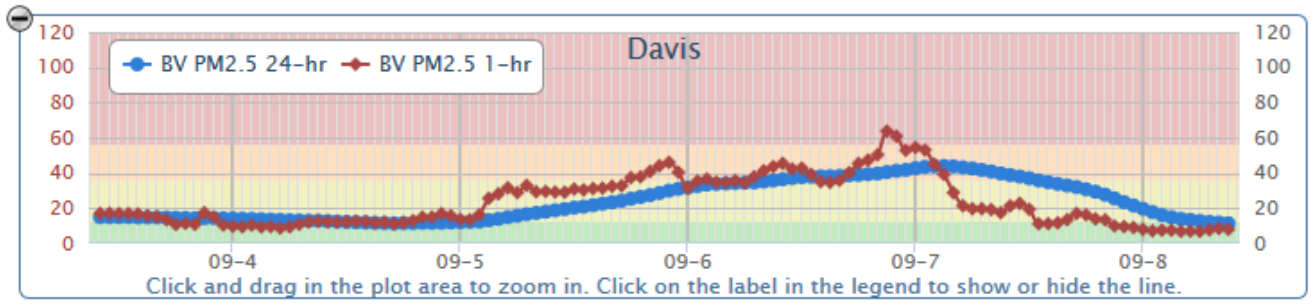


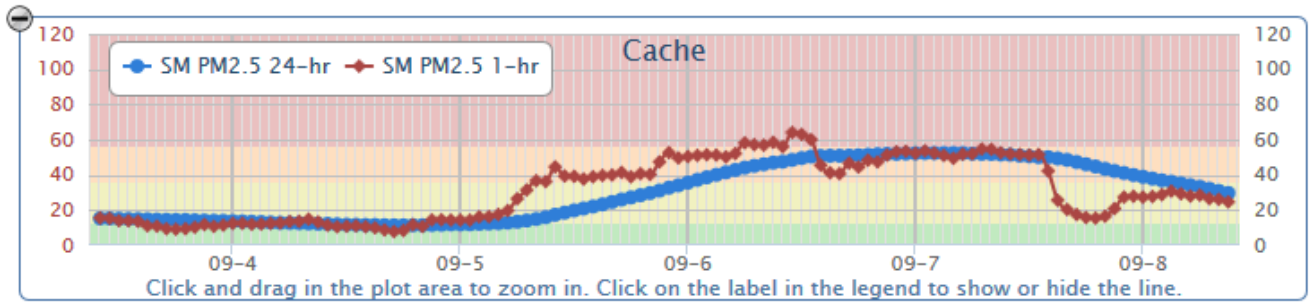


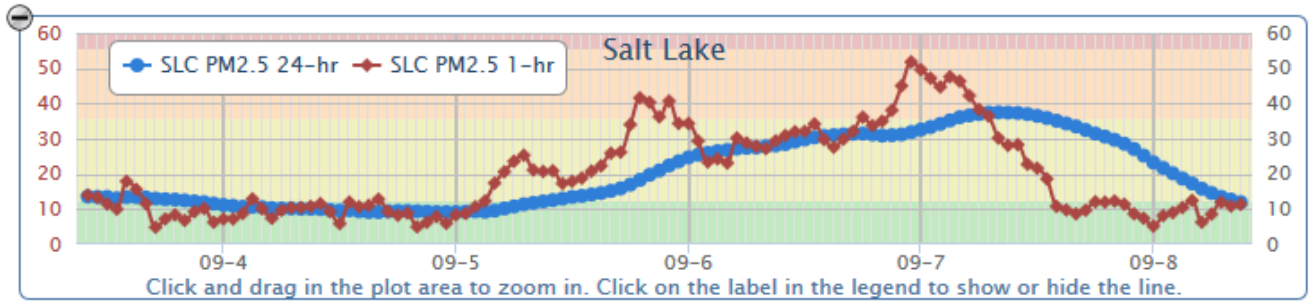
Air Quality Impact and Clear Causal Relationship

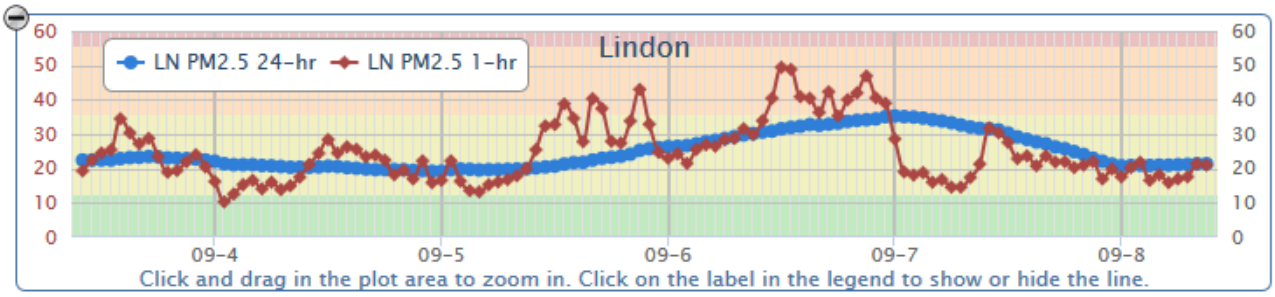
The $PM_{2.5}$ trend charts for the northern monitoring stations show elevated $PM_{2.5}$ levels corresponding with the smoke map projections starting September 5, 2017.

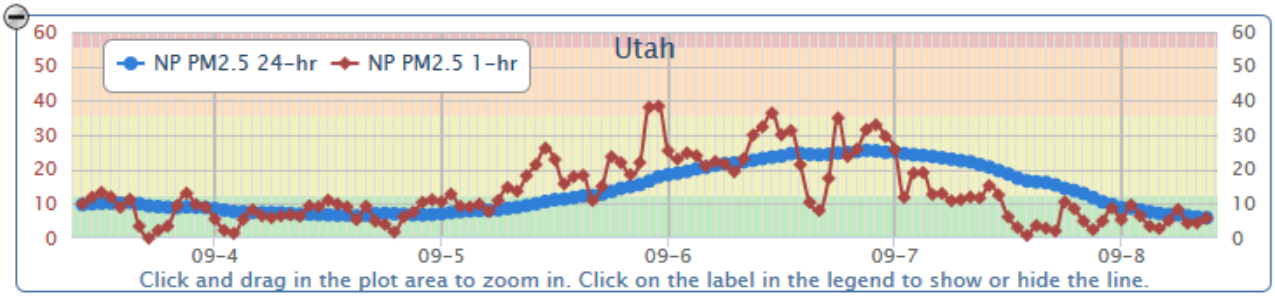









Lindon
LN PM2.5 24-hr
LN PM2.5 1-hr
60
50
40
30
20
10
0
09-4
09-5
09-6
09-7
09-8
Click and drag in the plot area to zoom in. Click on the label in the legend to show or hide the line.


Utah
NP PM2.5 24-hr
NP PM2.5 1-hr
60
50
40
30
20
10
0
09-4
09-5
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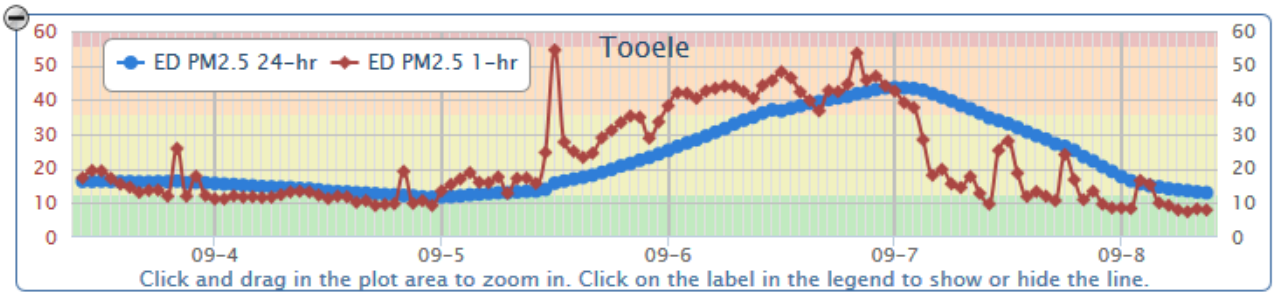
09-7
09-8
Click and drag in the plot area to zoom in. Click on the label in the legend to show or hide the line.


Tooele
ED PM2.5 24-hr
ED PM2.5 1-hr
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30
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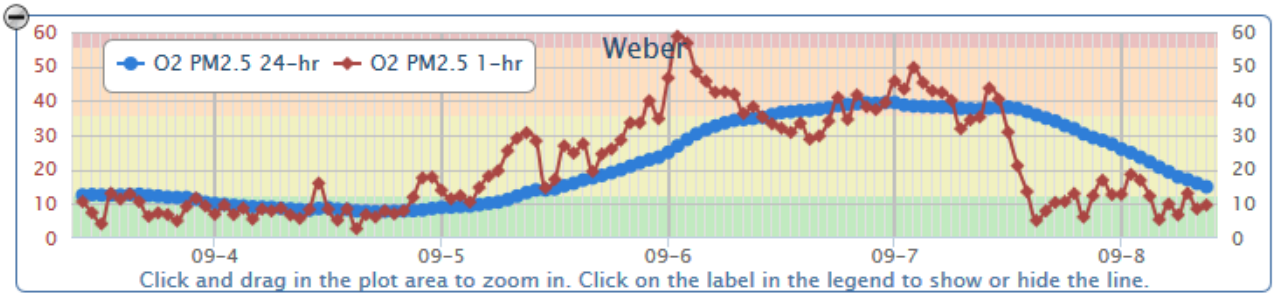
0
09-4
09-5
09-6
09-7
09-8
Click and drag in the plot area to zoom in. Click on the label in the legend to show or hide the line.


Weber
O2 PM2.5 24-hr
O2 PM2.5 1-hr
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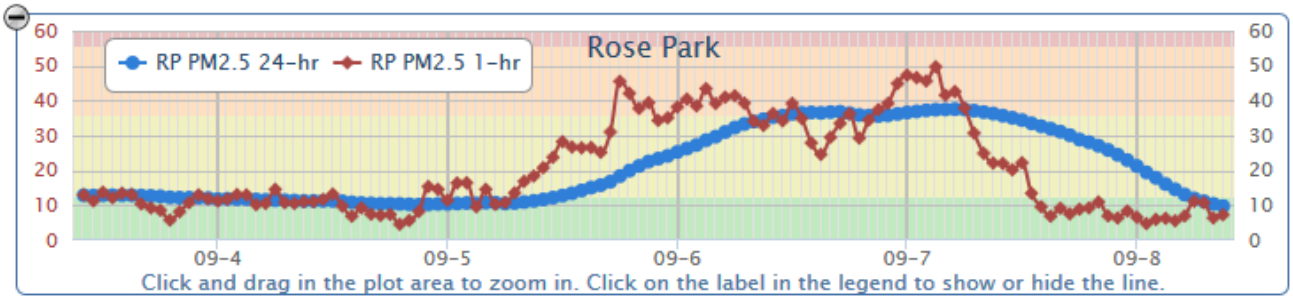
09-8
Click and drag in the plot area to zoom in. Click on the label in the legend to show or hide the line.


Rose Park
RP PM2.5 24-hr
RP PM2.5 1-hr
60
50
40
30
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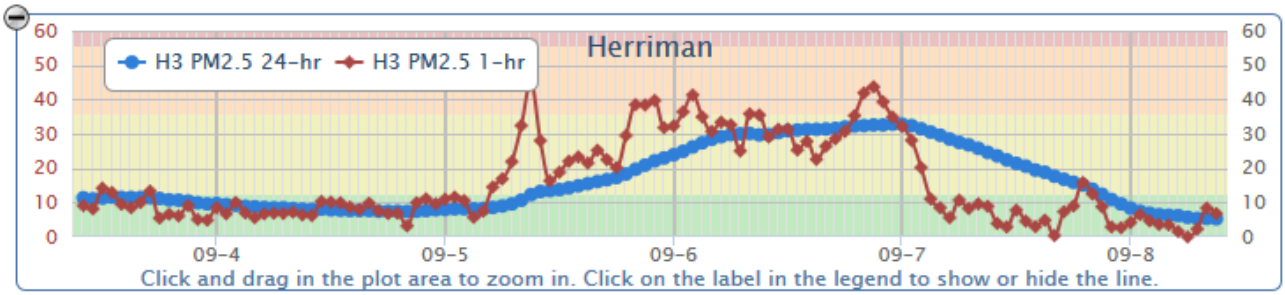
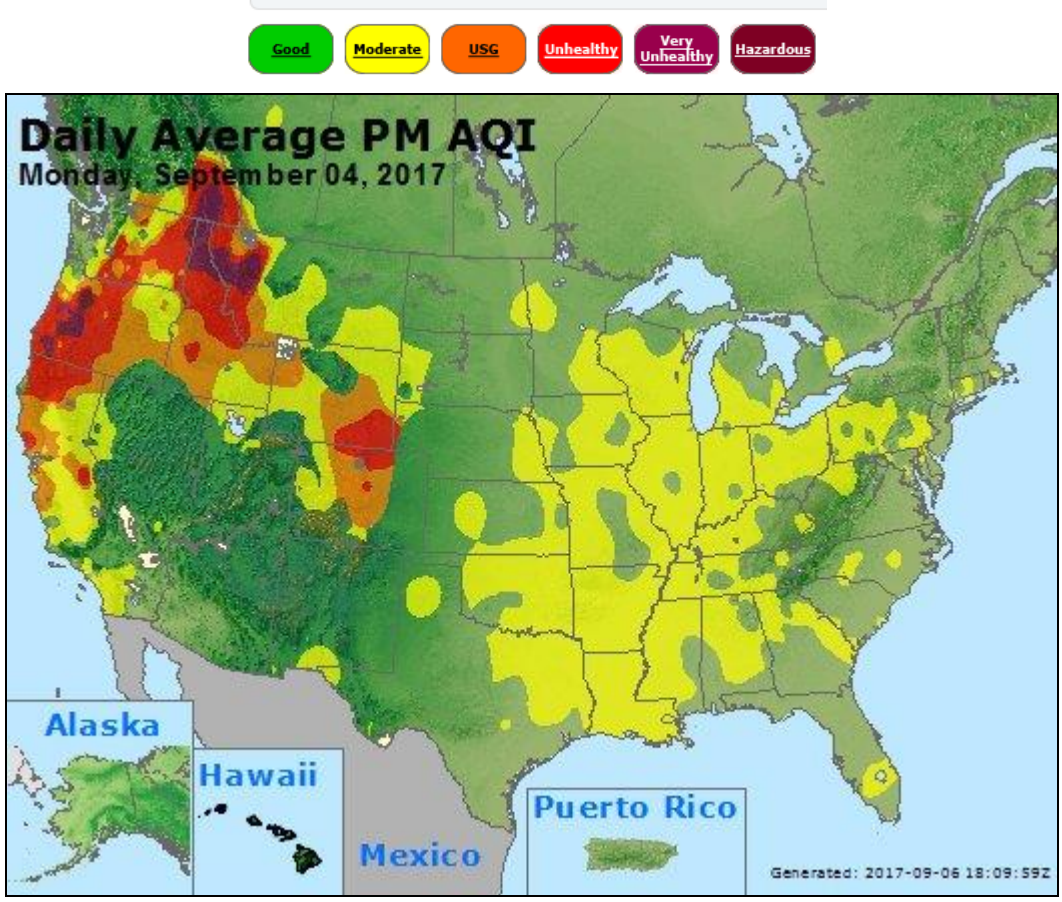
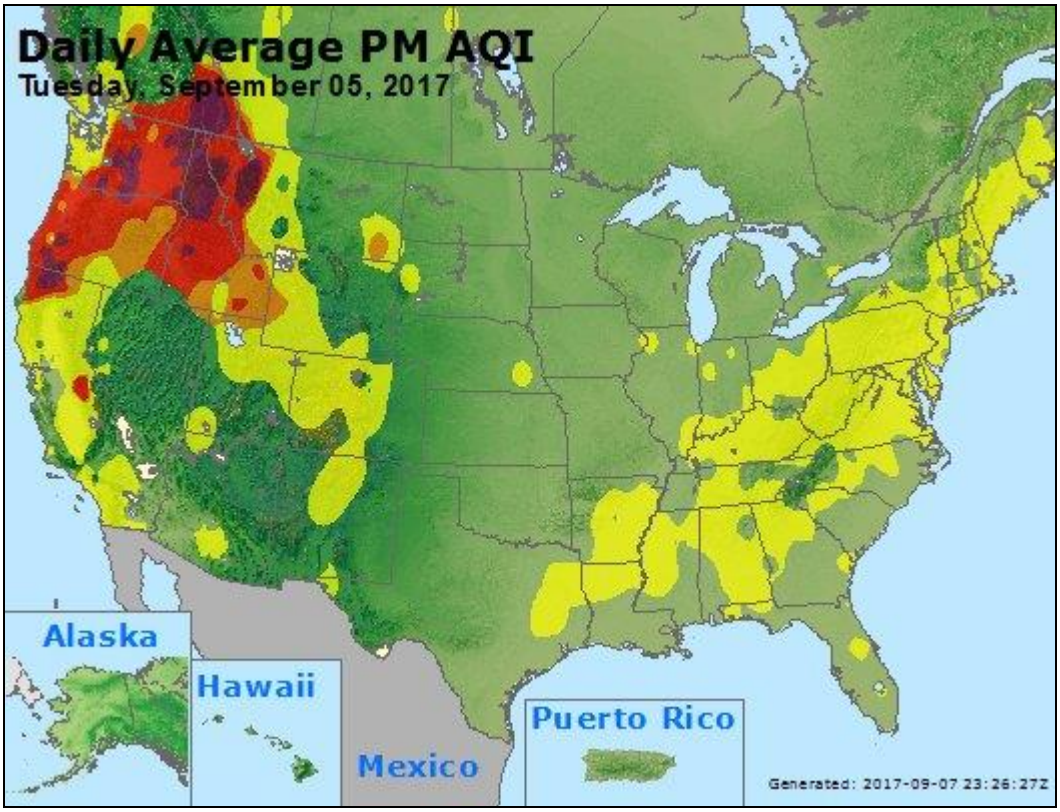
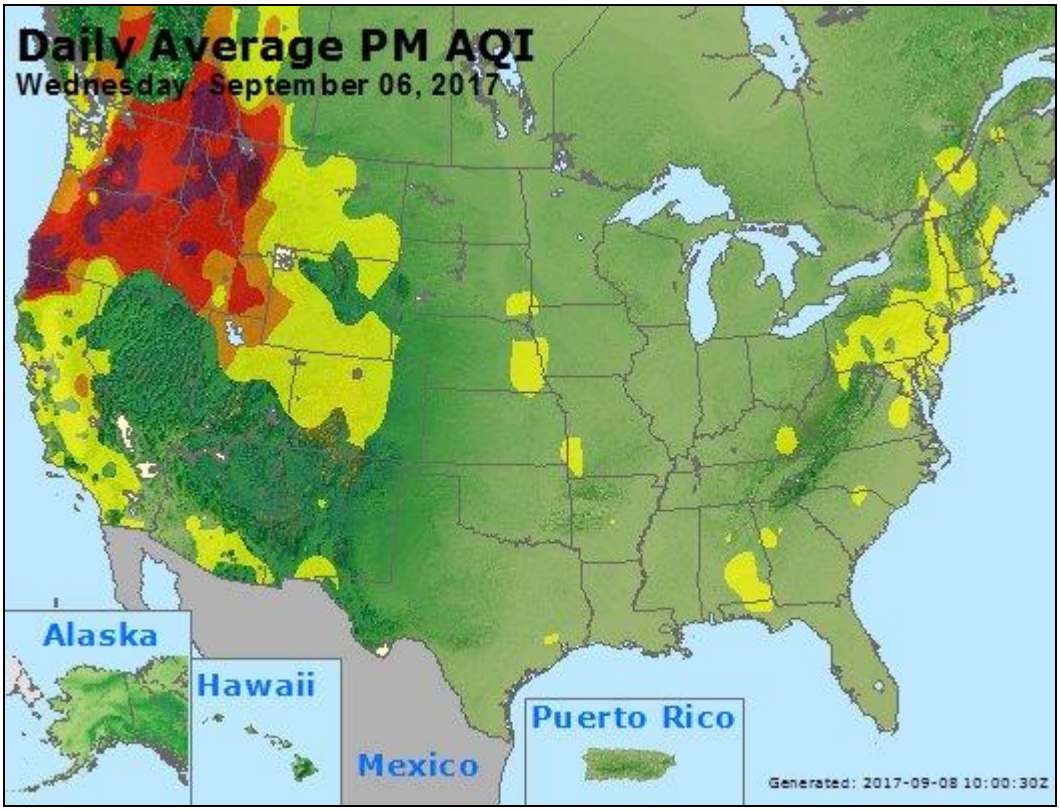
0
09-4
09-5
09-6
09-7
09-8
Click and drag in the plot area to zoom in. Click on the label in the legend to show or hide the line.

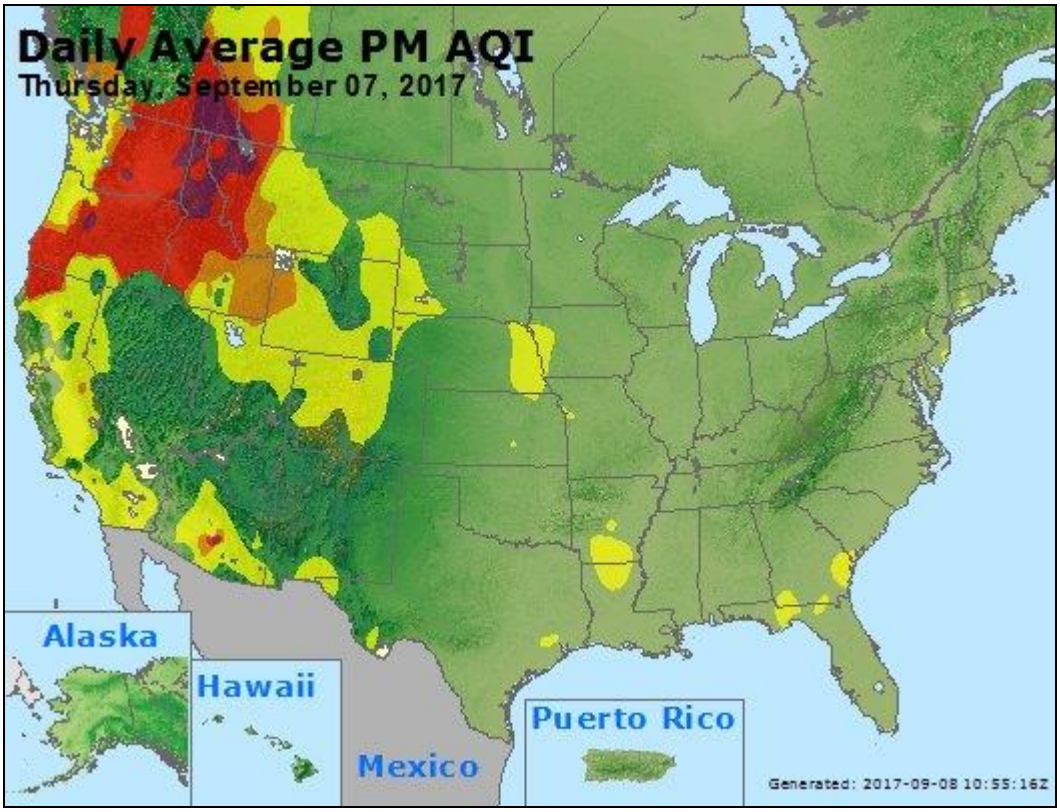


The EPA Air Quality Index maps from September 4 through 7. The air quality progressed from unhealthy (yellow) to unhealthy for sensitive groups (orange).



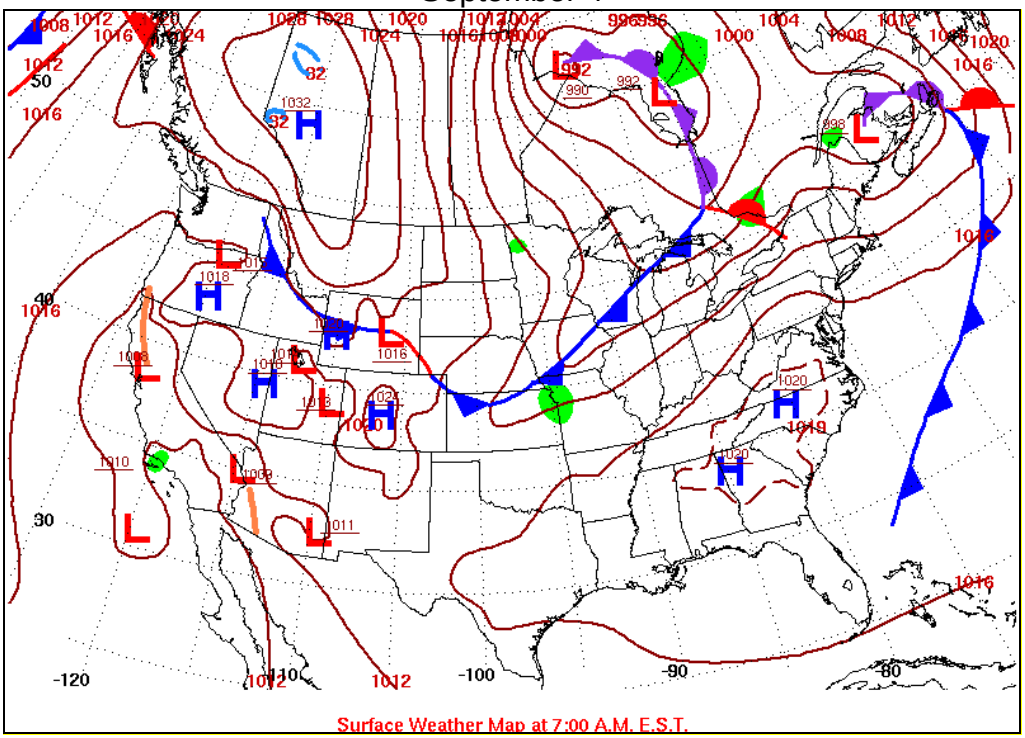

Daily Average PM AQI
Tuesday, September 05, 2017
Alaska
Hawaii
Mexico
Puerto Rico
Generated: 2017-09-07 23:26:27Z


Daily Average PM AQI
Wednesday, September 06, 2017
Alaska
Hawaii
Mexico
Puerto Rico
Generated: 2017-09-08 10:00:30Z

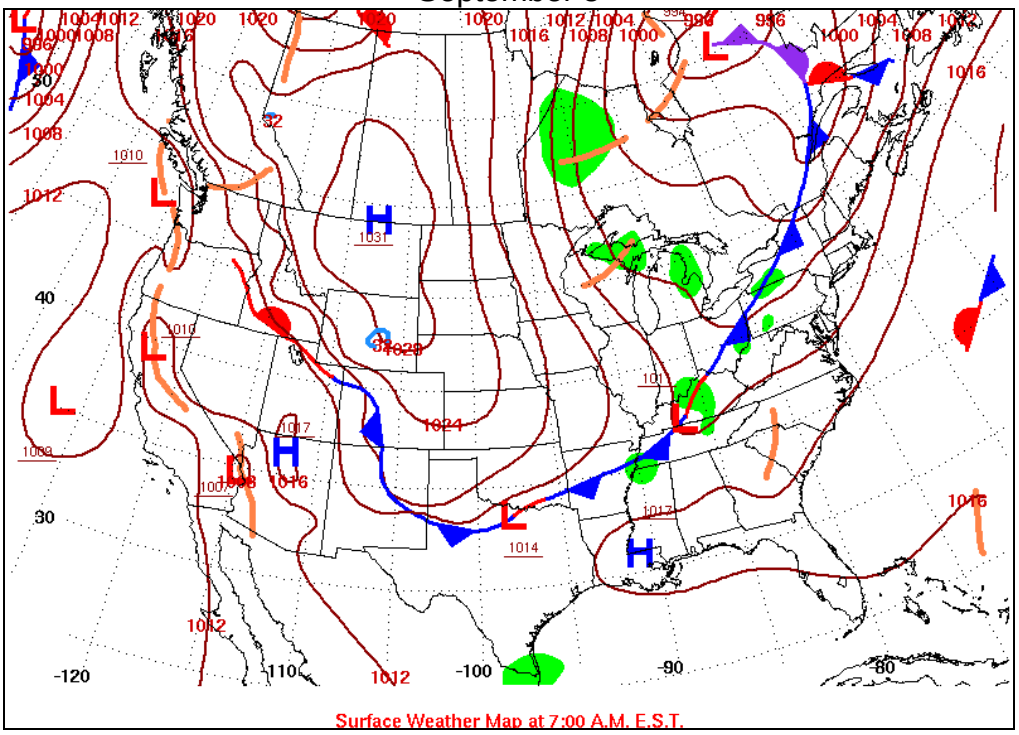


On September 4th at 0500 MST, a weak dry cold front was oriented from the northeast corner of Washington to the center of Wyoming, as can be seen in the surface weather maps. This cold front aided in fire intensification throughout Washington, Oregon, and Idaho September 4-5, in addition to transporting smoke-rich plumes from these states to the Wasatch Front and Cache Valley of Utah.

September 4

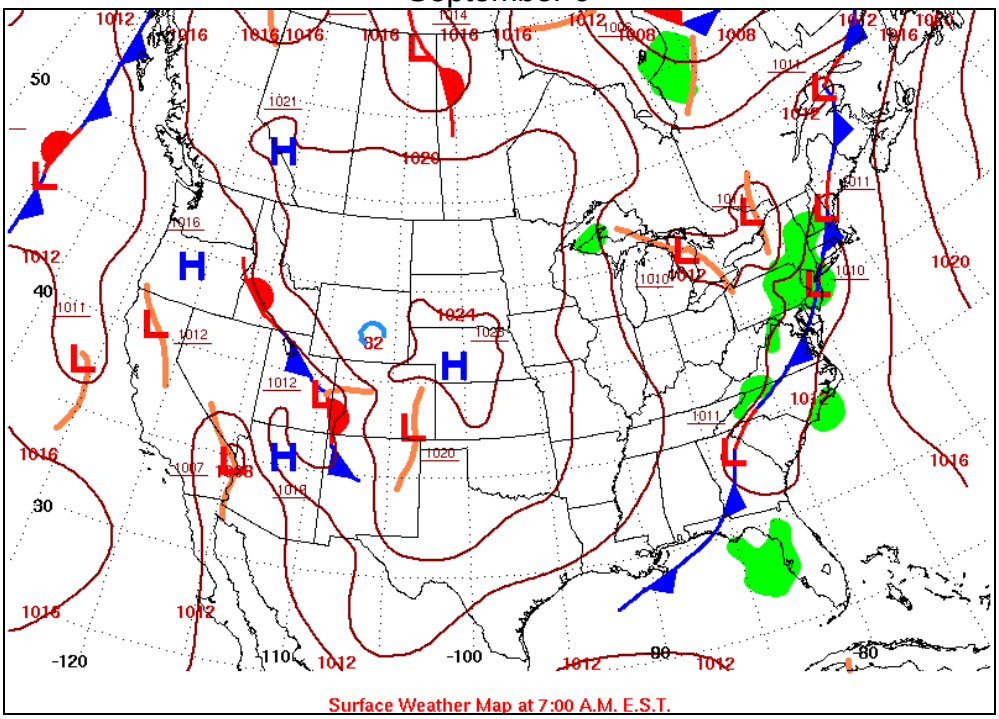


September 5

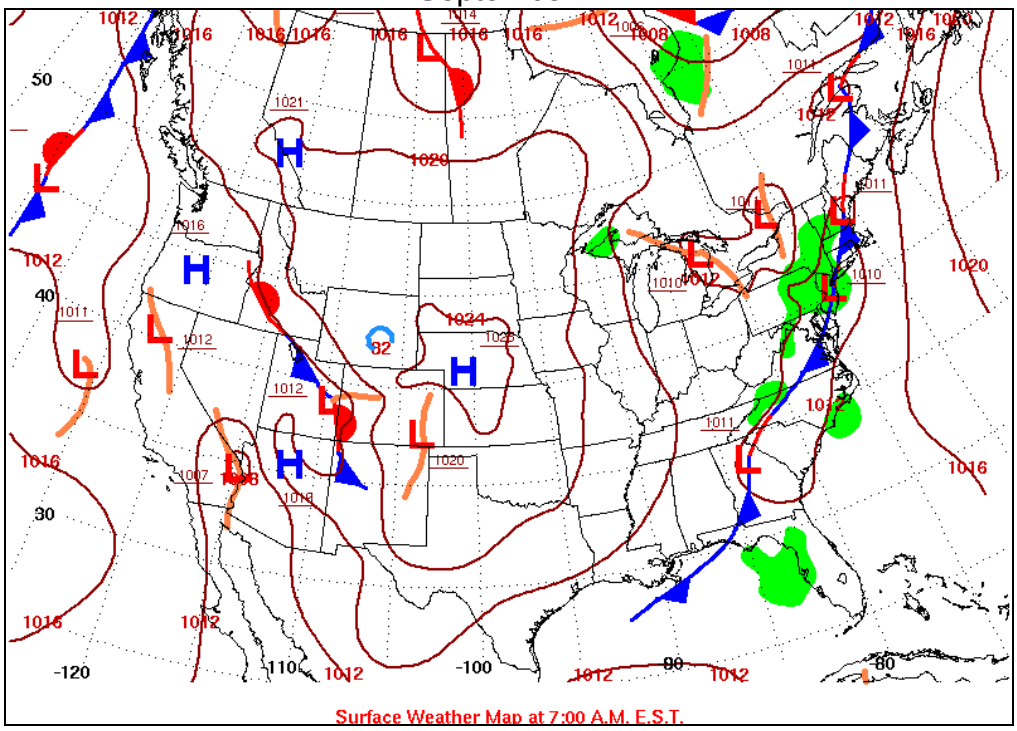


By the morning of September 5th, this cold front had stalled and further weakened into a stationary front, extending from northeast Oregon to west central Colorado. The stalled boundary further allowed transport from the fires in the Pacific Northwest to the Wasatch Front and Cache Valley, as the particulate values are seen to escalate during this time period.

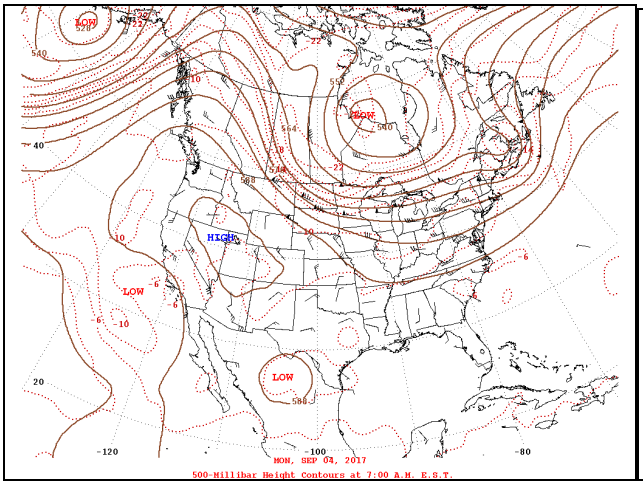
September 6

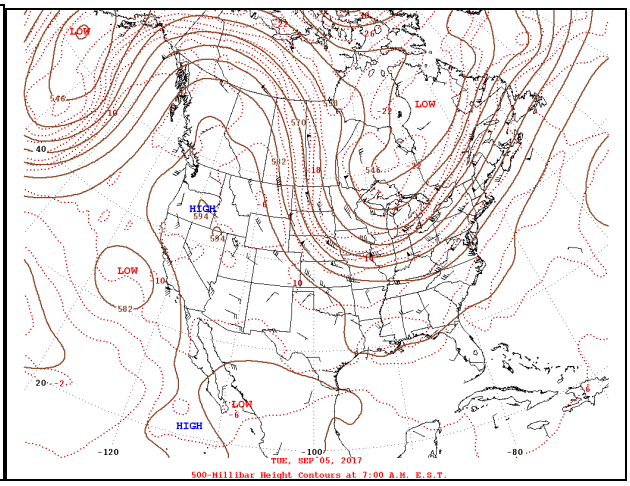


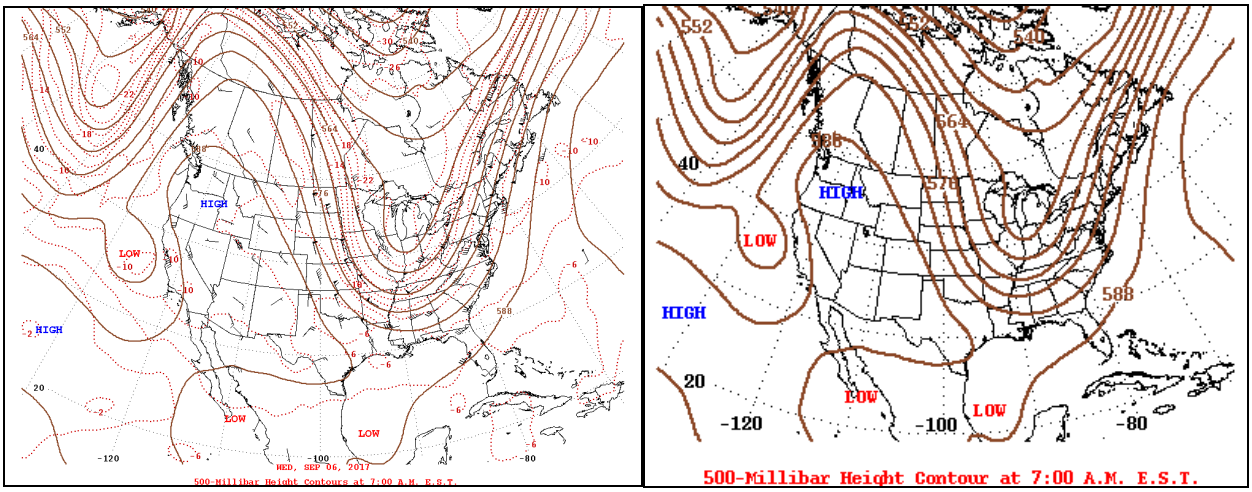
September 7



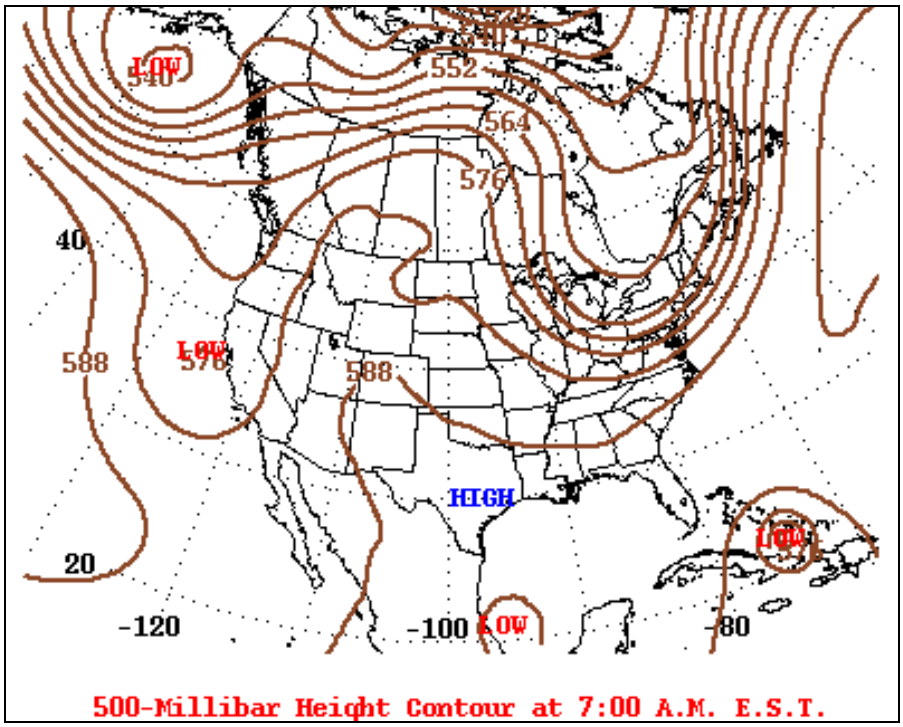
Extremely stable conditions due to a high pressure ridge aided in the intensified particulate concentrations from September 4-7, as can be seen in the 500-mb height contour maps. Additionally, due to smoke being transported at higher levels of the troposphere during this time period, diurnal mixing was not able to mix any clean air to the surface, as smoke was being entrained into the valleys of northeast Utah from above the boundary layer.



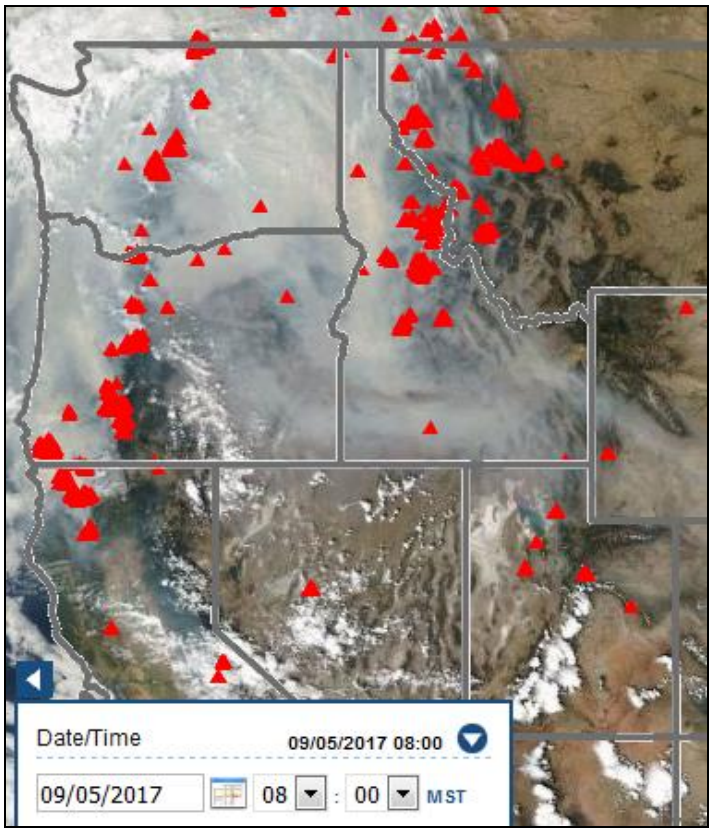


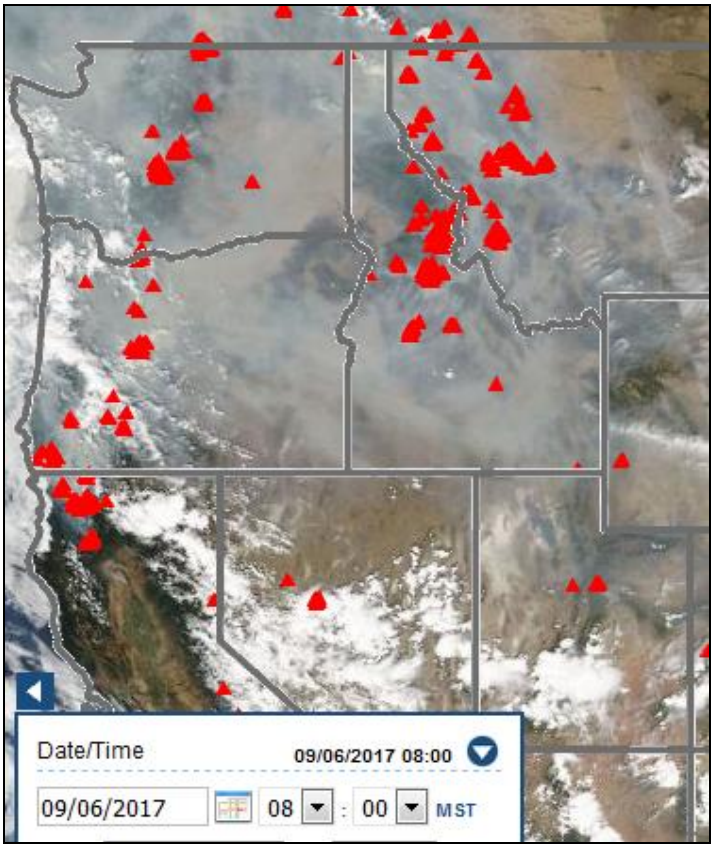


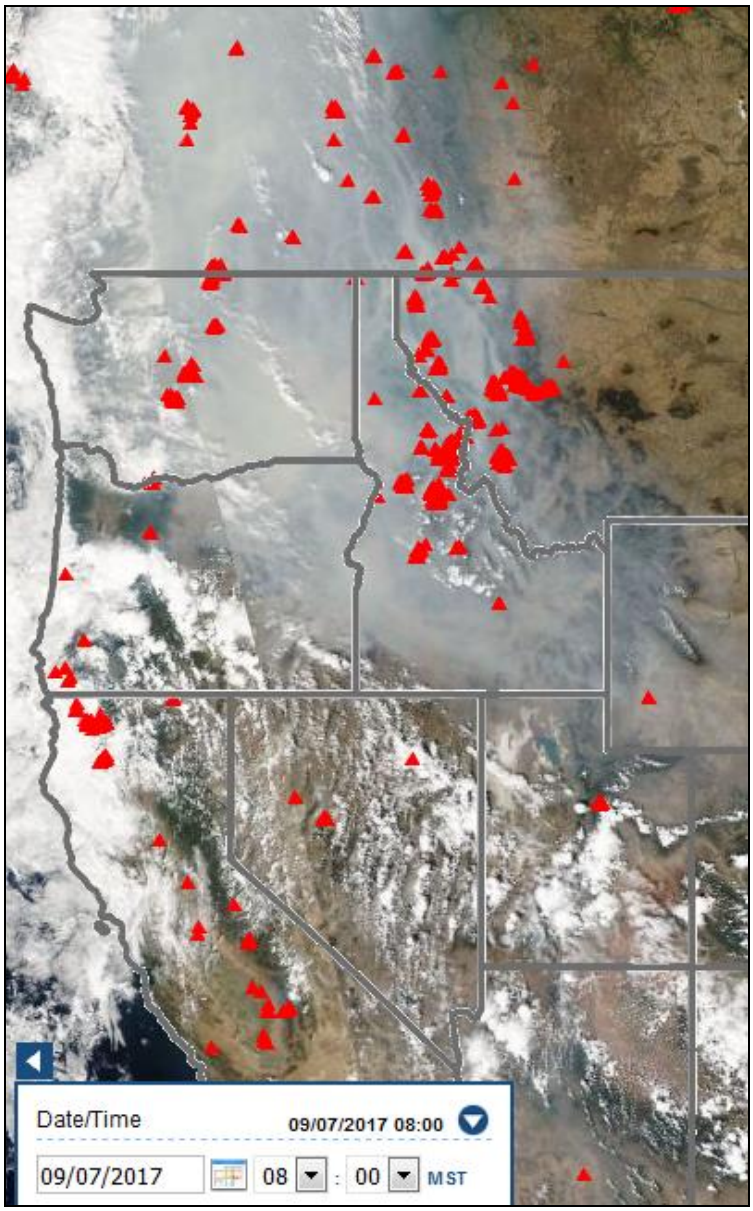
On September 8th, the ridge began to shift to the east, allowing for southerly flow to transport smoke free air from Arizona to the Wasatch front and Cache Valley. Particulate values were subsequently seen to drop down, as seen in the $PM_{2.5}$ time series for each of the stations.



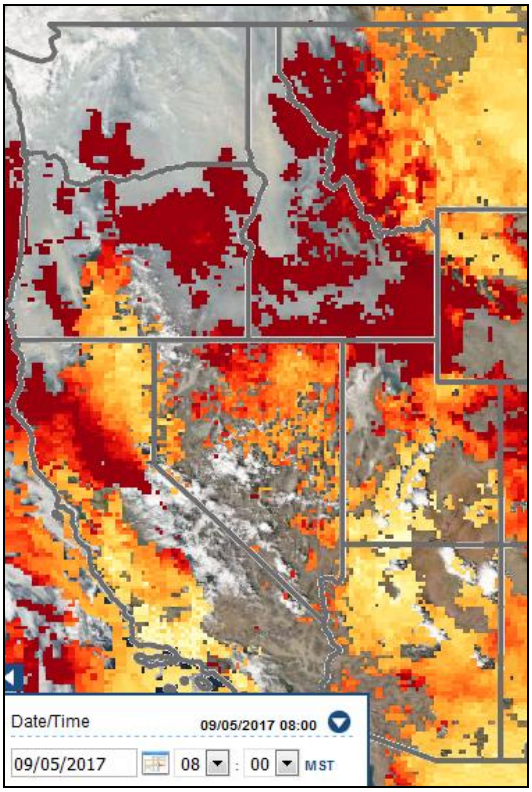
Smoke transport can be visibly verified with Modis satellite imagery. The red markers are the wildfire locations. The off-gray wisps are smoke plumes.

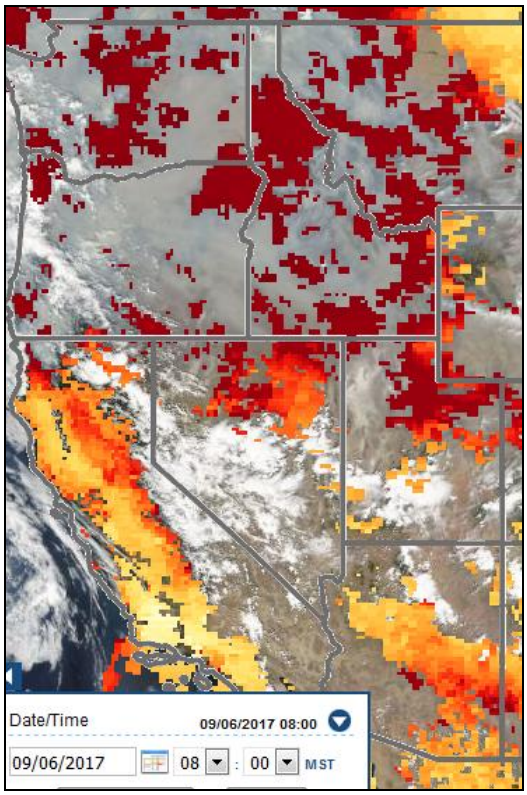


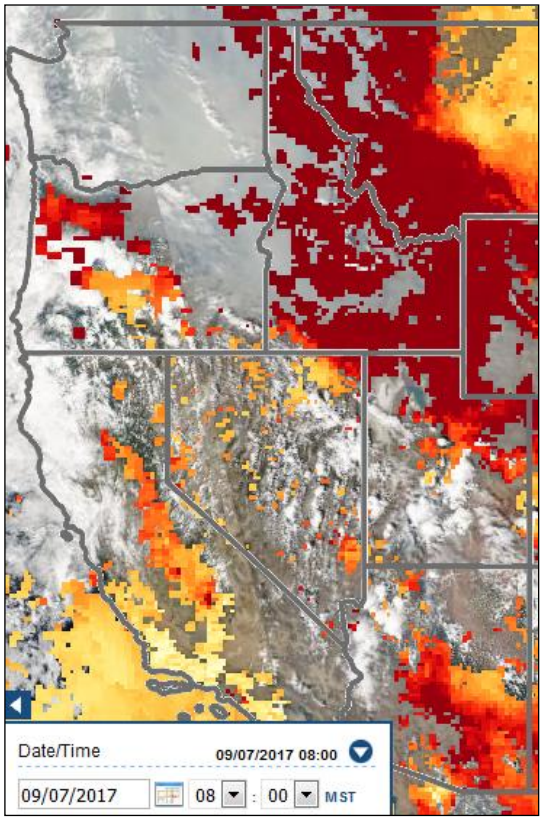



Date/Time
09/07/2017 08:00
09/07/2017
08
00
MST

Aerosol optical depth (AOD) is the degree to which aerosols prevent the transmission of light. When most particles are concentrated and well mixed in the boundary layer, satellite AOD measurements can provide supporting evidence of smoke. Smoke intensity is indicated by an increasing color scheme, with red as the maximum AOD. These are a series of AOD overlays on the Modis satellite image starting on September 5, when visible smoke was evident in Northern Utah.

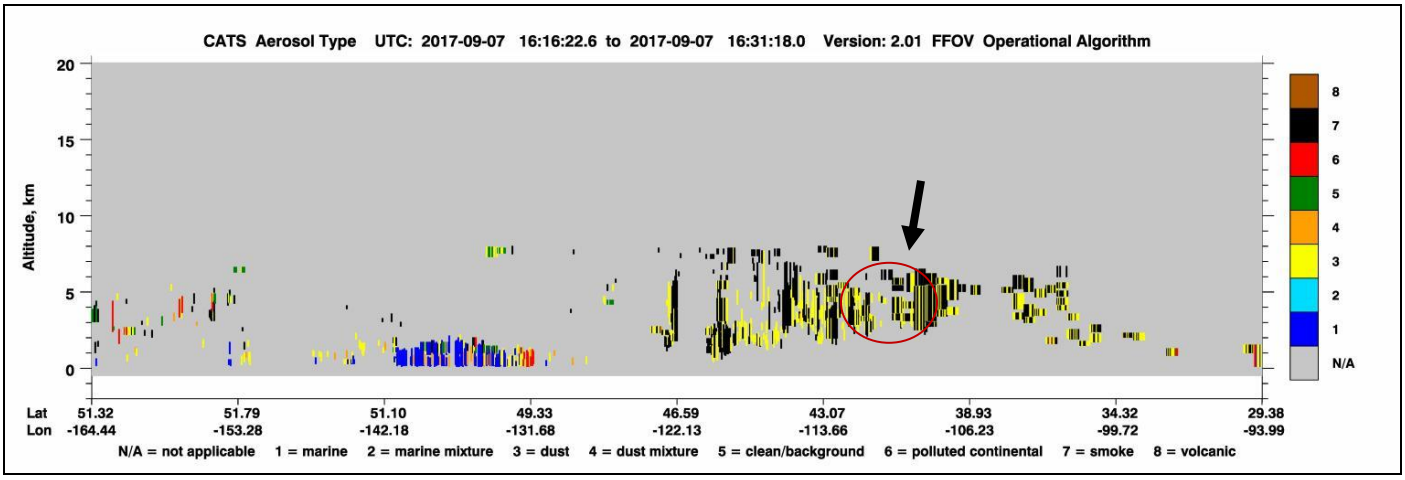






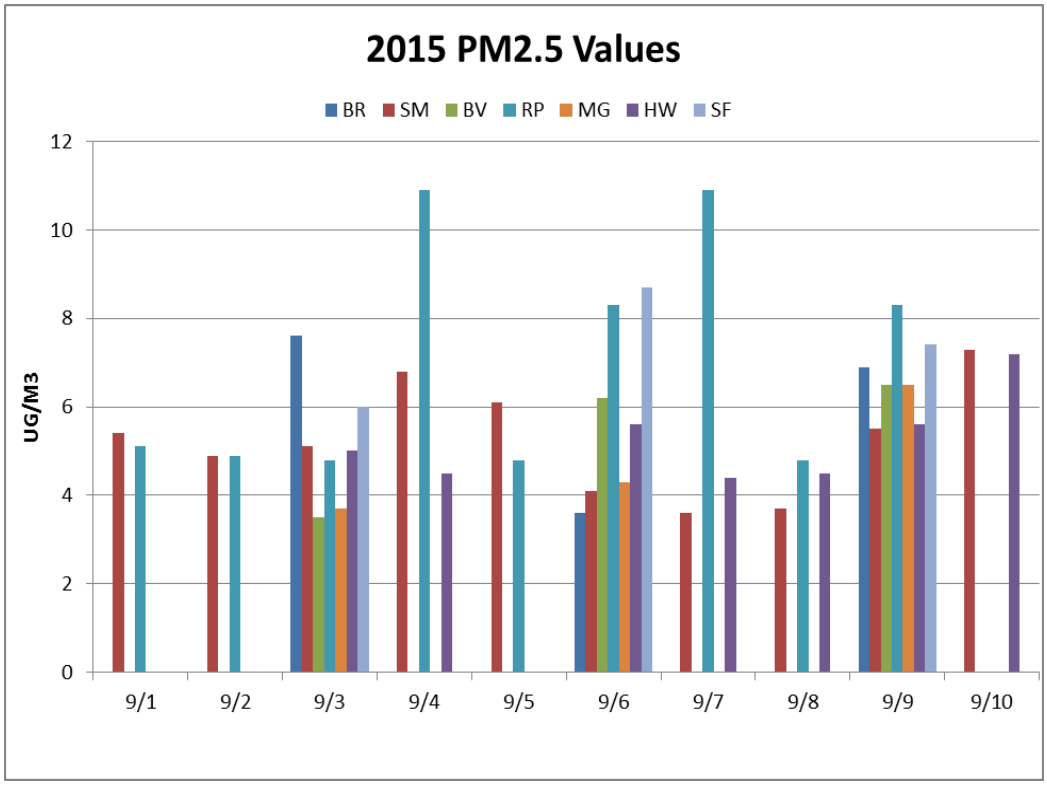
Satellite Remote Sensing of Air Quality using LIDAR

The CATS satellite uses LIDAR to profile the vertical aerosols. The LIDAR sensor emits radiation directed toward the target to be investigated. The radiation reflected from that target is detected and measured by the sensor. CATS made a pass over the smoke plume areas (highlighted area) during this event on September 7, 2017. The black marking indicates smoke. Note the extensive area where smoke was detected.

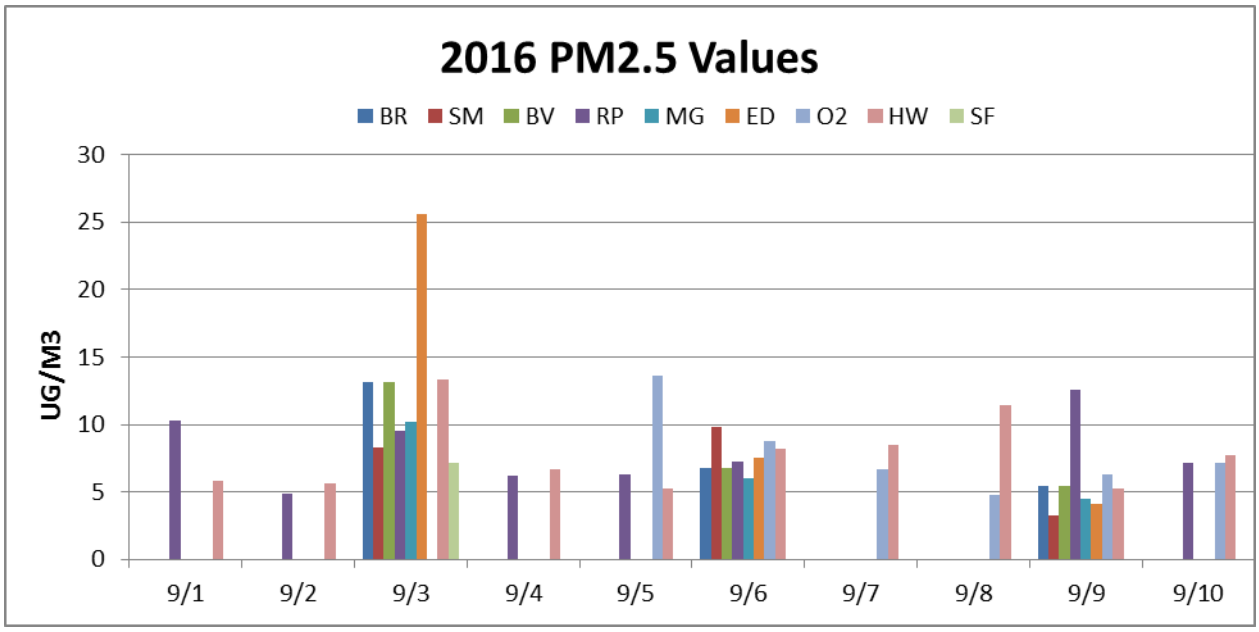


Historical Data

The plots show the values for the monitoring stations from September 1-10 for 2015-2017.



The average value across all stations during 2015 for this period was 5.9 µg/m^3.



The average value across all stations during 2016 for this period was 8.2 µg/m^3, even with the high value for Erda on September 3, 2016, that was due to the West Government Creek Fire. If we exclude the high Erda value on the 3rd, the average becomes 7.5 µg/m^3.

The West Government Creek Fire began on September 2, 2016, growing to 4,000 acres on September 3, 2016. The wildfire influence would explain the unusually high value of 25.6 µg/m^3.

West Government Creek Fire, 9:32 a.m. September 3, 2016, posted by Alpine Hotshots

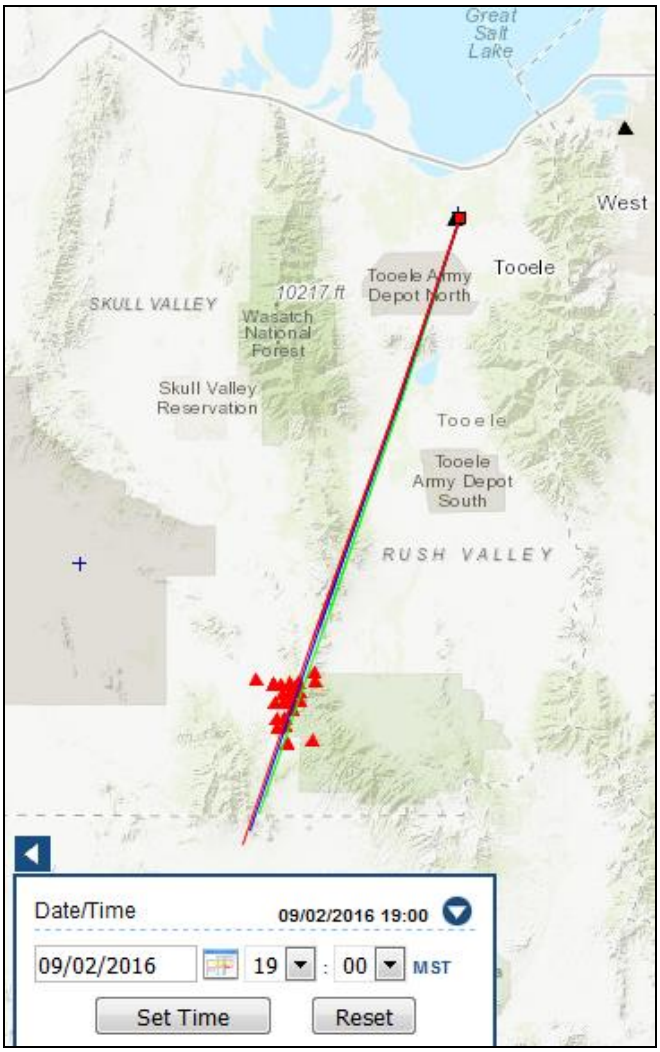
The satillite image on September 3, 2016 shows a smoke plume (circled) from the West Government Creek Fire (red dots) directly heading to the Erda monitoring station.

The following are the hourly $PM_{2.5}$ values from the Erda continuos monitor on September 2-3, 2016. We assume that values above 10 (highlighted) are times when smoke impacted the monitor. Consequently, we estimate that smoke from the West Government Creek Fire actually began during the late evening hours on September 2, 2016.

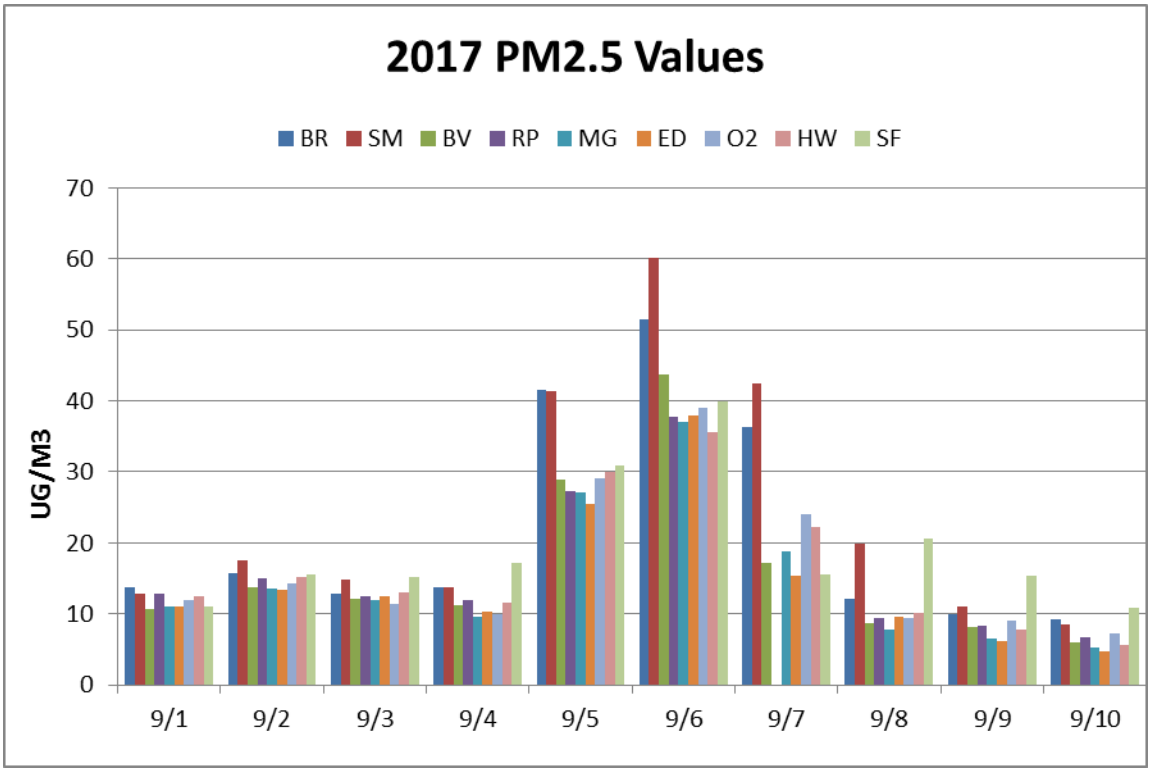
ED	9/2/2016	9/3/2016
	MC	MC
Hour	UG/M3	UG/M3
00:00	4.4	19.
01:00	4.5	18.3
02:00	4.7	18.4
03:00	3.9	14.8
04:00	4.6	12.7
05:00	4.8	13.
06:00	5.	13.1
07:00	5.3	14.2
08:00	6.9	13.2
09:00	11.3	12.5
10:00	10.1	10.8
11:00	7.	10.4
12:00	8.	9.3
13:00	9.7	8.4
14:00	4.9	9.1
15:00	3.8	8.2
16:00	10.	8.1
17:00	8.2	7.1
18:00	5.6	6.4
19:00	18.4	6.5
20:00	4.7	7.

21:00	13.3	6.3
22:00	25.6	5.6
23:00	23.5	5.4
Avg	8.6	10.7
Max	25.6	19.
Hr. of Max	36.29	17.333
Min	3.8	5.4

Hysplit back trajectory for 3-hours from 19:00 hours on September 2, 2016 from the Erda monitoring station confirms a direct line to the West Government Creek Fire.



The average value across all stations during 2017 for this period was 17.7 µg/m^3. Removing the Exceptional Events day exceedances yields an average of 13.6 µg/m^3. This average includes 20 days over 15 µg/m^3, including values in the twenties and thirties that are due to wildfire smoke.



Reasonable Controls

The Exceptional Events Rule requires that states have in place reasonable controls during exceptional events. The western wildfires were located outside of the State of Utah, beyond Utah control. None the less, the DAQ smoke management plan includes regulations that address open burning, prescribed burning and wildfire management.

- R307-202. Emission Standards: General Burning. This rule regulates when general burning can be conducted under permits issued by local fire authorities. Open burning periods are established in different parts of the state when the atmosphere can safely disperse smoke and when wildfire hazard is low. This rule also prohibits the burning of certain materials.

- R307-204. Emission Standards: Smoke Management. This rule is designed to mitigate the impact on public health of prescribed fires and wildfires by establishing strict requirements of land owners, state and federal agencies that conduct prescribed fires and actions necessary by the wildfire coordinators during a wildfire event. The state smoke manager (a Bureau of Land Management employee) processes all prescribed fire requests prior to submitting those requests for DAQ director approval. He assures that prescribed fire plans contain a smoke mitigation plan and that the burn will comply with R307-204.

The Department of Natural Resources has fire management jurisdiction in unincorporated and forest lands through R652-120.

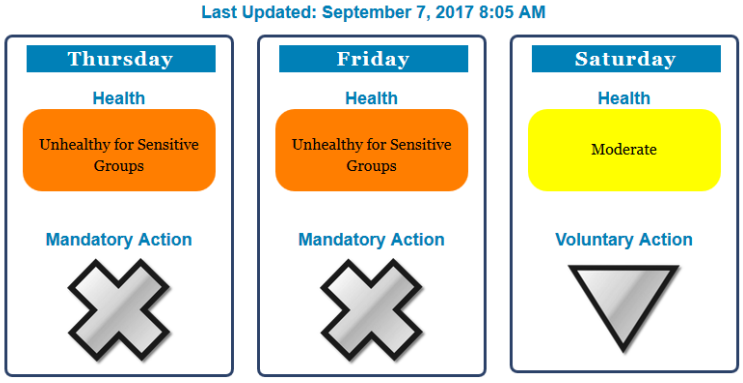
- R652-120. Wildland Fire. The State Forester enforces open burning of yard waste through a burn permit in unincorporated lands in the same manner as R307-202 which is designed for incorporated lands. This rule also deals with fire management and suppression and prescribed fire management.

Mitigation

1. News releases during the event advised citizens of the potential health impacts of smoke from the wildfires.

2. Web sites about emissions from wildfire are posted on the DEQ web site. They cover the health impacts of PM and actions a person could take to minimize exposure to PM.

3. UDAQ issues a 3-day air quality forecast. This air quality forecast was for this event.



Employers activate mandatory trip reduction programs. Individuals should **TravelWise** by consolidating trips and choose cleaner transportation options. Limit volatile organic compound (VOC) emissions. Smoke from wild fires could cause high concentrations of particulates in populated areas. If smoke becomes thick, persons with existing heart or respiratory ailments should reduce physical exertion and outdoor activity.

Explanation

The forecast indicates the highest pollution level of the day. During the summer, Ozone pollution levels are generally low during the morning, evening and night. During the winter, particulate matter (i.e., PM 2.5) pollution levels build up until a storm or weather system moves the air out of the valley.

The **health forecast** helps to determine how the highest pollution level of the day will affect people with various health conditions. Click on the "Health Forecast" legend to plan your physical activity to help minimize the effects of pollution on your health.

The **action forecast** notifies the public of the voluntary or mandatory actions (e.g., carpooling, wood burning) they need to adhere to for the current pollution levels. Click on the "Action Forecast" legend for a description of the action regulations.

Action Forecast

Unrestricted Action

Voluntary Action

Mandatory Action

Health Forecast

Air Quality Index (AQI)	PM 2.5	Ozone
Good	0 - 12.0 µg/m^3	0 - 0.054 ppm
Moderate	12.1 - 35.4 µg/m^3	0.055 - 0.070 ppm
Unhealthy for Sensitive Groups	35.5 - 55.4 µg/m^3	0.071 - 0.085 ppm
Unhealthy	55.5 - 150.4 µg/m^3	0.086 - 0.105 ppm
Very Unhealthy	150.5 - 250.4 µg/m^3	0.106 - 0.200 ppm
Hazardous	Above 250.5 µg/m^3	Above 0.201 ppm
	Based on a 24-hour average.	Based on an 8-hour average.

Proof of Public Comment

Environmental Quality
Air Quality

Notice of Public Comment for Wildfire Exceptional Events on September 6 - 7, 2017

Federal regulations, 40 Code of Federal Regulations (CFR) Part 50, allow states to exclude air quality data that exceed or violate a National Ambient Air Quality Standard (NAAQS) if they can demonstrate that an "exceptional event" has caused the exceedance or violation. Exceptional events are unusual or naturally occurring events that can affect air quality but are not reasonably controllable or preventable using techniques implemented to attain and maintain the NAAQS.

Exceptional events may be caused by human activity that is unlikely to recur at a particular location, or may be due to a natural event. The Environmental Protection Agency (EPA) defines a "natural event" as an event in which human activity plays little or no direct causal role to the event in question. For example, a natural event could include such things as high winds, wild fires, and seismic/volcanic activity. In addition, the EPA will allow states to exclude data from regulatory determinations on a case-by-case basis for monitoring stations that measure values that exceed or violate the NAAQS due to emissions from fireworks displays from cultural events.

Federal regulations (40 CFR Part 50.14) require that all relevant flagged data, the reasons for the data being flagged, and a demonstration that the flagged data are caused by exceptional events be made available by the State for 30 days of public review and comment. These comments will be considered in the final demonstration of the event that is submitted to EPA. The following monitoring stations air quality exceedances have been attributed to a wildfire exceptional event.

Monitoring Station	Date	PM 2.5 microgram/m³	Standard microgram/m³
Brigham City	9/5/17	41.5	35
Smithfield	9/5/17	41.4	35
Bountiful	9/6/17	43.8	35
Brigham City	9/6/17	51.5	35
Erda	9/6/17	38	35
Hawthorne	9/6/17	35.5	35
Ogden	9/6/17	39.1	35
Magna	9/6/17	37.1	35
Rose Park	9/6/17	37.8	35
Smithfield	9/6/17	60.1	35
Spanish Fork	9/6/17	39.9	35
Lindon	9/6/17	35	35
Brigham City	9/7/17	36.4	35
Smithfield	9/7/17	42.4	35